BMP-32

BMP: PERMANENT SEEDING

Definition

The establishment of perennial vegetative cover on disturbed areas by planting seed.

Purposes

1. To reduce erosion and decrease sediment yield from disturbed areas.
2. To permanently stabilize disturbed areas in a manner that is economical, adaptable to site conditions, and allows selection of the most appropriate plant materials.
3. To improve wildlife habitat.
4. To enhance natural beauty.

Conditions Where Practice Applies

1. Disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil.
2. Rough-graded areas which will not be brought to final grade for a year or more.

Planning Considerations

Vegetation controls erosion by reducing the velocity and the volume of overland flow and protecting the bare soil surface from raindrop impact.

Areas which must be stabilized after the land has been disturbed require vegetative cover. The most common and economical means of establishing this cover is by seeding grasses and legumes.

Advantages of seeding over other means of establishing plants include the small initial establishment cost, the wide variety of grasses and legumes available, low labor requirement, and ease of establishment in difficult areas.

Disadvantages which must be dealt with are the potential for erosion during the establishment stage, a need to reseed areas that fail to establish, limited periods during the year suitable for seeding, the potential need for weed control during the establishment phase, and a need for water and appropriate climatic conditions during germination.

There are so many variables in plant growth that an end product cannot be guaranteed. Much can be done in the planning stages to increase the chances for successful seeding. Selection of the right plant materials for the site, good seedbed preparation, and conscientious maintenance are important.

Selecting Plant Materials - The factors affecting plant growth are climate, soils, and topography. In selecting appropriate plant materials, one should take into account the characteristics of the physiographic region in which the project is located.

Soils - Soils can be modified with lime and fertilizer, but climate cannot be controlled. Microclimate, or localized climate conditions, can affect plant growth. A south-facing slope is drier and hotter than a north-facing slope, and may require drought-tolerant plants. Shaded areas require shade-tolerant plants; the windward side of a ridge will be drier than the leeward, etc.

Land Use - A prime consideration in selecting which plants to establish is the intended use of the land. All of these uses - residential, industrial, commercial, recreational - can be separated into two major categories: high-maintenance and low-maintenance.

High-Maintenance will be mowed frequently, limed and fertilized regularly, and will either receive intense use (e.g., athletics) or require maintaining to an aesthetic standard (home lawns). Grasses used for these situations must be fine-leaved and attractive in appearance, able to form tight sod, and be long-lived perennials. They must be well-adapted to the geographic area where they are planted, because constant mowing puts turf under great stress. Sites where high-maintenance vegetative cover is desirable include homes, industrial parks, schools, churches, athletic playing surfaces as well as some recreational areas.

Low-maintenance areas will be mowed infrequently or not at all; lime and fertilizer may not be applied on a regular basis; the areas will not be subjected to intense use, nor required to have a uniform appearance. These plants must be able to persist with little maintenance over long periods of time. Grass and legume mixtures are favored for these sites because legumes are capable of fixing nitrogen

from the air for their own use, and the use of the plants around them. Such mixed stands are better able to withstand adverse conditions.

Sites that would be suitable for low-maintenance vegetation include steep slopes, stream or channel banks, some commercial properties, and "utility turf' areas such as roadbanks.

Seedbed Preparation - The soil on a disturbed site must be modified to provide an optimum environment for seed germination and seedling growth. The surface soil must be loose enough for water infiltration and root penetration. The pH (acidity and alkalinity) of the soil must be such that it is not toxic and nutrients are available, usually between pH 6.0-7.0. Sufficient nutrients (added as fertilizer) must be present. After seed is in place, it must be protected with a mulch to hold moisture and modify temperature extremes, and to prevent erosion while seedlings are growing.

The addition of lime is equally as important as applying fertilizer. Lime is best known as a pH, or acidity, modifier, but it also supplies calcium and magnesium which are plant nutrients. Its effect on pH makes other nutrients more available to the plant. It can also prevent aluminum toxicity by making aluminum less soluble in the soil.

Maintenance: Even with careful, well-planned seeding operations, failures can occur. When it is clear that plants have-not germinated on an area or have died, these areas must be reseeded immediately to prevent erosion damage. However, it is extremely important to determine for what reason germination did not take place and make any corrective action necessary prior to reseeding the area. Healthy vegetation is the most effective erosion control available.

Specifications

Selection of Plant Materials -

Selection of plant materials is based on climate, topography, soils, land use, and planting season. To determine which plant materials are best adapted to a specific site, use Tables 32-1 and 32-2 which describe plant characteristics and list recommended varieties.

A more extensive description of plant materials (grasses and legumes) and their usage can be found in Appendix 32-c.

TABLE 32-1 CHARACTERISTICS OF COMMONLY SELECTED GRASSES

Common Name (Botanical Name)		Life Cycle	Season	pH Range	Germination Time in Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seed Per Pound	Maintenance Requirements	Remarks
Tall Fescue (Festuca arundinacea)		Perennial	Cool Season Plant	5.5 - 6.2	10 - 14	60 -85	Fair	Fair	Medium	Somewhat Poorly Drained	225K	Low when used for erosion control; high when used in lawn.	Better suited for erosion control and rough turf application.
Tall Fescues (Improved)		Perennial	Cool Season Plant	5.5 - 6.2	10-14	60-85	Fair	Good	Medium	Somewhat Poorly Drained	220K	Responds well to high maintenance.	Excellent for lawn and fine turf.
Kentucky Bluegrass (Poa pratense)		Perennial	Cool Season Plant	6.0 - 6.5	14	60 -75	Good	Poor	Medium	Somewhat Poorly Drained	2.2M	Needs fertile soil, favorable moisture. Requires several years to become well established.	Excellent for fine turfs-takes traffic, mowing. Poor drought/heat tolerance.
Perennial Tyegrass (Lolium perenne)		Perennial	Cool Season Plant	5.8 - 6.2	7 -10	60 - 75	Fair	Fair	Medium - High	Somewhat Poorly Drained	227K	Will tolerate traffic.	May be added to mises. Imporved varieties will perform well all year.
Fine Fescues	Hard Fescue (Festuca longifolia)	Perennial	Cool Season Plant	5.0 - 6.2	10 - 14	60 - 80	Very Good	Good	Low	Moderately Well Drained	400K	Grows well in sun or shade and will tolerate infertile soils; improved disease resistance.	Exceeds all fine fescues in most tests. Excellent for low-maintenance situations.
	Chewing Fescue	Perennial	Cool Season Plant	5.0-6.2	10 - 14	60 - 80	Very Good	Good	Low	Moderately Well Drained	400K	Tolerates shade, dry infertile soils.	Poor traffic tolerance, less thatch than other fine fescues.
	Red Fescue (Festuca rubra)	Perennial	Cool Season Plant	5.0-6.2	10 -14	60 - 80	Very Good	Good	Low	Moderately Well Drained	400K	Low to medium fertility requirements. Requires well drained soil.	Spreads by rhizomes, tillers and stolons. Will not take traffic - very shade tolerant.
Reed Canarygrass (Phalaris arundinacea)		Perennial	Cool Season Plant	5.8 - 6.2	21	70 - 85	Good	Good	Medium - High	Very Poorly Drained	530K	Do not mow closely or often.	Conservation cover in wet areas.

TABLE 32-1 CHARACTERISTICS OF COMMONLY SELECTED GRASSES

Common Name (Botanical Name)	Life Cycle	Season	pH Range	Germination Time in Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seed Per Pound	Maintenance Requirements	Remarks
Redtop (Agrostis alba)	Perennial	Cool Season Plant	5.8 - 6.2	10	65 - 85	Good	Fair	Low	Poorly Drained	5M	Will tolerate poor, infertile soils; deep rooted.	Does will in erosion control mixes - not for lawns.
Weeping Lovegrass (Evagrostis curvula)	Perennial	Warm Season Plant	4.5 - 6.2	14	65 - 85	Fair - Poor	Good	Low - Medium	Somewhat Poorly Drained	1.5M	Low-fertility requirements; excellent drought tolerance.	Fast-growing, warm-season bunch grass. Excellent cover for erosion control.
Bermudagrass (Cynodon dactylon)	Perennial	Warm Season Plant	5.8 - 6.2	21	70 -95	Poor	Good	Medium - High	Somewhat Poorly Drained	1.8M hulled	High nitrogen utilization, excellent drought tolerance.	Common varieties used for erosion control. Hybrids used for fine turf.
Orchardgrass (Dactylis glomerata)	Perennial	Cool Season Plant	5.8 - 6.2	18	60 - 75	Fair	Fair	Medium	Somewhat Poorly Drained	625K	Does best on well-drained, loamy soil.	Good pasture selection - may be grazed.
Annual Ryegrass (Lolium multiflorum)	Annual	Cool Season Plant	5.8 - 6.2	7	60 - 70	Good	Poor	Medium - High	Somewhat Poorly Drained	227 K	Do not use in fine-turf areas.	May be added into mixes or established alone as temporary cover in spring and fall.
Rye (Secale cereale)	Annual	Cool Season Plant	5.8 - 6.2	7	55 -70	Very Good	Good	Low - Medium	Somewhat Poorly Drained	18K	Do not use in fine-turf areas.	May be added into mixes or established alone for late fall/winter cover.
Foxtail Millet (setaria italica)	Annual	Warm Season Plant	5.8 - 6.2	10	65 - 85	Very Poor	Good	Medium	Moderately Well Drained	220K	Establishes well during summer. Very low moisture requirements.	May be added to erosion-control mixes or extablished alone.

TABLE 32-2 CHARACTERISTICS OF LEGUMES APPROPRIATE FOR EROSION CONTROL

Common Name (Botanical Name)	Life Cycle	Season	pH Range	Germination Time in Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seed Per Pound	Maintenance Requirements	Remarks
Crownvetch (coronilla varia)	Perennial	Cool Season Plant	6.0 - 6.5	14 - 21	70	Good	Very Good	Medium	Moderately Well Drained	110K	Does best on well-drained soils. Minimum maintenance when established. May need phosphorus. Inoculation is essential.	Excellent for steep, rocky slopes. Produces colorful blooms in May/June. slow to establish. Does best when seeded in spring.
Sericea Lespedeza (Lespedeza cuneata)	Perennial	Warm Season Plant	5.8 - 6.2	21 - 28	70-85	Fair	Very Good	Low	Moderately Poorly Drained	335K	Grows in most well-drained soils. Low fertility requirements. Inoculation is essential.	Use hulled seed in spring; unhulled in fall. Very deep-rooted legume.
Flatpea (Lathyrus silvestrus)	Perennial	Cool Season Plant	5.0 - 7.0	14 - 28	65 -75	Good	Good	Low	Poorly Drained	15K	Needs lime and high phosphorus. Good shade tolerance.	Tolerates acidic and wetter soils better than other legumes.
Birdsfoot Trefoil (Lotus corniculatus)	Perennial	Cool Season Plant	6.0 - 6.5	7	65 - 70	Good	Fair	Medium	Somewhat Poorly Drained	375K	Inoculation is essential. Grows in medium-fertile, slightly acid soils.	Grows better on poorly drained soils than most legumes. Poor drought/heat tolerance.
Annual Lespedezas (Lespedeza striata, L. stipulacea)	Annual	Warm Season Plant	5.8 - 6.2	14	70 - 85	Fair	Very Good	Low	Moderately Well Drained	200K	Will grow on almost any well-drained soil.	Needs almost no nitrogen to survive.
Red Clover (Trifolium pratense)	Perennial	Cool Season Plant	6.0-6.5	7 - 14	70	Good	Fair	Medium	Somewhat Poorly Drained	275K	Needs high levels of phosphorus and potassium.	Acts as a biennial. Can be added to low-maintenance mixes.
White Clover (Trifolium repens)	Perennial	Cool Season Plant	6.0-6.5	10	70	Good	Poor	Medium	Poorly Drained	700K	Requires favorable moisture, fertile soils, high pH.	Spreads by soil surface stolons, white flowers.

Seedbed Requirements-

Vegetation should not be established on slopes that are unsuitable due to inappropriate soil texture, poor internal structure or internal drainage, volume of overland flow, or excessive steepness, until measures have been taken to correct these problems.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil must have these characteristics:

1. Enough fine-grained material to maintain adequate moisture and nutrient supply.

2. Sufficient pore space to permit root penetration. A bulk density of 1.2 to 1.5 indicates that sufficient pore space is present. A fine granular or crumb-like structure is also favorable.

3. Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans shall be 300 millimeters (12 inches) or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.

4. A favorable pH range for plant growth. If the soil is so acidic that a pH range of 6.0-7.0 cannot be attained by addition of ph-modifying materials, then the soil is considered an unsuitable environment for plant roots and further soil modification would be required.

5. Freedom from toxic amounts of materials harmful to plant growth.

6. Freedom from excessive quantities of roots, branches, large stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they do not significantly impede good seed soil contact.

If any of the above criteria cannot be met, i.e., if the existing soil is too coarse, dense, shallow, acidic, or contaminated to foster vegetation, then topsoil shall be applied in accordance with TOPSOILING, BMP-30.

Necessary structural erosion and sediment control practices will be installed prior to seeding. Grading will be carried out according to the approved plan.

Surfaces will be roughened in accordance with SURFACE ROUGHENING, BMP-29.

Soil Conditioners -

In order to modify the texture, structure, or drainage characteristics of a soil, the following materials may be added to the soil:

1. Peat is a very costly conditioner, but works well. If added, it shall be sphagnum moss peat, hypnum moss peat, reed-sedge peat or peat humus, from fresh-water sources. Peat shall be shredded and conditioned in storage piles for at least six months after excavation.

2. Sand shall be clean and free of toxic materials. Sand modification is ineffective unless you are adding 80 to 90% sand on a volume basis. This is extremely difficult to do on-site. If this practice is considered, consult a professional authority to ensure that it is done properly.

3. Vermiculite shall be horticultural grade and free of toxic substances. It is an impractical modifier for larger acreage due to expense.

4. Raw manure, is more commonly used in agricultural applications. However, when stored properly and allowed to compost, it will stabilize nitrogen and other nutrients. Manure, in its composted form, is a viable soil conditioner; however, its use should be based on site-specific recommendations offered by a professional in this field.

5. Thoroughly rotted sawdust shall have 3.5 kilograms of nitrogen added to each cubic meter (6 pounds per cubic yard) and shall be free of stones, sticks, and toxic substances.

6. The use of treated sewage sludge has benefitted from continuing advancements in its applications in the agricultural community. When composted, it offers an alternative soil amendment. Limitations include a potentially undesirable pH (because of lime added during the treatment process) and the possible presence of heavy metals. This practice should be thoroughly evaluated by a professional and be used in accordance with any local, state, and federal regulations.

Lime and Fertilizer -

Lime and fertilizer needs should be determined by soil tests. Soil tests may be performed by a reputable commercial laboratory. Reference Appendix 32-d for liming applications (in lbs.) needed to correct undesirable pH for various soil types.

Under unusual conditions where it is not possible to obtain a soil test, the following soil amendments will be applied:

Lime

Coastal Plain:	4,480 kg/ha (2 tons/acre) pulverized agricultural grade limestone (448 kg/1000 m^2 - 90 lbs/1000 ft^2)
Piedmont and Appalachian Region:	4,480 ka/ha (2 tons/acre) pulverized agricultural grade limestone (448 kg/1000 m^2 - 90 lbs/1000 ft^2)

Note: An agricultural grade of limestone should always be used.

Fertilizer

Mixed grasses and legumes:	1,120 kg/ha (1000 lbs/acre) of 10-20-10 or equivalent nutrients (112 kg/1000 m^2 - 1000 23 lbs./1000 ft^2).
Legume stands only:	1,120 kg/ha (1000 lbs/acre) 5-20-10 (112 kg/ 1000 m^2 - 23 lbs/1000 ft^2) is preferred; however, 1,120 kg/ha (1000 lbs/acre) of 10-20-10 or equivalent may be used.
Grass stands only:	1,120 kg/ha (1000 lbs/acre) 10-20-10 or equivalent nutrients, (112 kg/1000 m^2 - 1000 23 lbs./1000 ft^2).

Other fertilizer formulations, including slow-release sources of nitrogen (preferred from a water quality standpoint), may be used provided they can supply the same amounts and proportions of plant nutrients.

Incorporation - Lime and fertilizer shall be incorporated into the top 100-150 millimeters (4-6 inches) of the soil by discing or other means whenever possible. For erosion control, when applying lime and fertilizer with a hydroseeder, apply to a rough, loose surface.

Seeding

1. Certified seed will be used for all permanent seeding whenever possible. Certified seed is inspected by the state certifying agency. The seed must meet published state standards and bear an official "Certified Seed" label. (see Appendix 32-a).

2. Legume seed should be inoculated with the inoculant appropriate to the species. Seed of the Lespedezas, the Clovers and Crownvetch should be scarified to promote uniform germination.

3. Apply seed uniformly with a broadcast seeder, drill, culti-packer seeder, or hydroseeder on a firm, friable seedbed. Seeding depth should be 1/4 to 1/2 inch.

4. To avoid poor germination rates as a result of seed damage during hydroseeding, it is recommended that if a machinery breakdown of 30 minutes to 2 hours occurs, 50% more seed be added to the tank, based on the proportion of the slurry remaining in the tank. Beyond 2 hours, a frill rate of new seed may be necessary.

   Often hydroseeding contractors prefer not to apply lime in their rigs as it is abrasive. In inaccessible areas, lime may have to be applied separately in pelletized or liquid form. Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage of lime, fertilizer and seed.

   Legume inoculants should be applied at five times the recommended rate when inoculant is included in the hydroseeder slurry.

Mulching -

All permanent seeding must be mulched immediately upon completion of seed application. Refer to MULCHING, BMP-35.

Maintenance of New Seedings -

In general, a stand of vegetation cannot be determined to be fully established until it has been maintained for one full year after planting.

Irrigation: New seedings should be supplied with adequate moisture. Supply water as needed, especially late in the season, in abnormally hot or dry weather, or on adverse sites. Water application rates should be controlled to prevent excessive runoff. Inadequate amounts of water may be more harmful than no water.

Re-seeding: Inspect seeded areas for failure and make necessary repairs and re-seedings within the same season, if possible.

a. If vegetative cover is inadequate to prevent rill erosion, over-seed and fertilize in accordance with soil test results.

b. If a stand has less than 40% cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. The soil must be tested to determine if acidity or nutrient imbalances are responsible. Re-establish the stand following seedbed preparation and seeding recommendations.

Fertilization: Cool season grasses should begin to be fertilized 90 days after planting to ensure proper stand and density. Warm season fertilization should begin at 30 days after planting.

Apply maintenance levels of fertilizer as determined by soil test. In the absence of a soil test, fertilization should be as follows:

Cool Season Grasses (per 1000 m^2 per year)

20 kg nitrogen (N) (4 lbs/1000 ft^2)

5 kg phosphorus (P) (1 lbs/1000 ft^2)

10 kg potash (K) (2 lbs/1000 ft^2)

Seventy-five percent of the total requirements should be applied between September 1 and December 31st. The balance should be applied during the remainder of the year. **More than 5 kg. of soluble nitrogen per 1000 m^2 should not be applied at any one time (1 lb per 1,000 ft^2)**.

Warm Season Grasses

Apply 20-25 kg (4-5 lbs/1000 ft^2) nitrogen (N) between May 1 and August 15th per 1000 m^2 per year.

Phosphorus (P) and Potash (K) should only be applied according to soil test.

Note: The use of slow-release fertilizer formulations for maintenance of turf is encouraged to reduce the number of applications and the impact on groundwater.

Additional Information on the Successful Establishment of Grasses and Legumes

See Appendix 32-b for "helpful hints" in achieving high success rates in grass or legume plantings.